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MINERALOGY.—*Mullite, a silicate of alumina.*[1] N. L. BOWEN, J. W. GREIG, and E. G. ZIES. Geophysical Laboratory, Carnegie Institution of Washington.

INTRODUCTION

The compound $Al_2O_3 \cdot SiO_2$ occurring in the three forms sillimanite, andalusite, and cyanite has hitherto been regarded as the only compound of alumina and silica existing in nature. Of the three forms sillimanite has been accepted as the stable one under pyrogenetic conditions, but a recent study shows that it is necessary to make drastic modifications of existing conceptions in this regard. An investigation of the equilibrium relations of alumina and silica has shown that there is only one compound of these oxides stable in contact with liquid in the binary system.[2] This compound is $3Al_2O_3 \cdot 2SiO_2$ but crystals of it show such remarkable similarity with natural sillimanite that they have been identified with sillimanite by a number of workers examining synthetic mixtures and artificial products of various kinds.

The investigation noted above showed that this 3:2 compound is the only stable compound not only at the very high temperatures where liquid occurs in the binary system but also at temperatures as low as 1000°C. and probably much lower. In view of this fact it seemed to us that the compound could scarcely fail of occurrence in natural rocks though here again probably determined as sillimanite. The most promising material for the occurrence of the 3:2 compound

[1] Received March 10, 1924.

[2] Papers reporting the results of this investigation were presented by Bowen and Greig at the recent meetings of the Geological Society of America and of the American Ceramic Society. Journ. Amer. Ceramic Soc., April, 1924.

appeared to be the so-called sillimanite buchites or fused argillaceous sediments occurring rather frequently as inclusions in Tertiary intrusives of the Western Isles of Scotland. These have been noted by various writers, but those occurring in Mull have recently been the subject of a most interesting study in a paper by Dr. H. H. Thomas to whom we are greatly indebted for specimens of buchite.[3] It may be stated in advance that this material from Mull has fully justified our expectations.

The inclusions described by Thomas embrace the "sillimanite" buchites, which appear to be largely the product of direct fusion of phyllites, together with a number of varieties in which anorthite, hypersthene, and other minerals have been developed as a result of interaction of the inclusions and doleritic magma. It is the buchites proper that are of particular interest in the present connection. Of these we have examined two, one from Seabank Villa and the other from Nun's Pass. A chemical analysis of the latter is given by Thomas. The rocks consist principally of glass in which are embedded very rare plates of corundum and abundant minute prisms of a mineral having all the properties of sillimanite in so far as these can be measured in thin section. Careful measurements of the refractive indices of these crystals show, however, that the values are too low for sillimanite and, as will be shown more fully in the following, the crystals are to be identified with the compound $3Al_2O_3 \cdot 2SiO_2$. This compound has hitherto been recognized only in synthetic products. Its occurrence in natural rocks necessitates a mineralogical name and for this we propose the term, *mullite*, after the locality whence came the rocks in which it is here first identified, the Island of Mull.

PURE SYNTHETIC MULLITE

The pure compound $3Al_2O_3 \cdot 2SiO_2$ can be prepared by sintering a mixture of alumina and silica in the proportions demanded by the formula. A mass consisting exclusively of crystals of one kind is thus obtained, a fact which consitutes the best evidence of the composition of the compound. It is obtained also, together with other phases, in mixtures of alumina and silica in other proportions. In all these cases it has the same properties which are closely related to, yet distinct from, those of sillimanite. Comparison of their prop-

[3] *On certain Xenolithic Tertiary Minor Intrusions in the Island of Mull (Argyllshire)*. Quar. Jour. Geol. Soc., **78**: 229–260. 1922. See also the fine new map. Geol. Survey Scotland, Mull, sheet 44, 3d edition, 1923.

erties is best given in tabular form (see Table 1) but, by way of emphasizing the similarity in those properties most readily determined, it may be stated that both form prisms of nearly square cross section with a perfect cleavage whose trace is parallel to the shorter diagonal of this section. The plane of the optic axes is parallel to this cleavage and the elongation of the prisms is positive. Only when we turn to properties to which definite numerical values can be assigned do the differences become apparent, and even then they are not very great. The sillimanite from Delaware County, Pennsylvania, with which mullite is compared is one that we selected as being particularly pure and of which an analysis is given in Table 3.

TABLE 1.—PROPERTIES OF PURE MULLITE AND OF SILLIMANITE

	MULLITE	SILLIMANITE*
Crystal system	Orthorhombic	Orthorhombic
Prism angle $(110 \wedge 1\bar{1}0)$	89° 13′	88° 15′
Cleavage	‖010	‖010
Optic orientation	$c = \gamma$ and $b = \alpha$	$c = \gamma$ and $b = \alpha$
Refractive indices γ	1.654	1.677
Refractive indices α	1.642	1.657
Axial angle, 2V	+45°–50°	+25°–30°

* The optical properties were measured on the sillimanite from Delaware County, Pennsylvania, of which an analysis is given in Table 3. The prism angle is that ordinarily given for sillimanite in the text-books.

Mullite was synthesized as long ago as 1865 by Sainte-Claire Deville and Caron.[4] They passed SiF_4 over a mixture of alumina and silica at a bright red heat and obtained crystals which had the composition given under I and II, Table 2. We have repeated the experiment and find that the crystals have refractive indices identical with those of pure mullite made by other methods.

Vernadsky separated crystals of mullite from Sèvres porcelain by means of hydrofluoric acid and analyzed the crystals. He found the composition given under III, Table 2. On the basis of these results he assigned the formula $11Al_2O_3 \cdot 8SiO_2$ to his own and to Deville's crystals.[5]

Cox separated the crystals from a burned fire clay and analyzed them with results given under IV and V, Table 2.[6] He accepts Vernadsky's formula.

[4] Ann. Chim. Phys. **5**: 114. 1865.
[5] Bull. Soc. Min. France **13**: 270. 1890.
[6] A. H. Cox, Geol. Mag. (Decade 6) **5**: 61. 1918.

All of these analyses agree in placing the composition somewhat more siliceous than the 3:2 ratio yet not so siliceous as the 11:8 ratio. In view of the fact that mullite crystals are particularly prone to carry small inclusions of the siliceous liquid in which they grow, this small excess of silica is probably not to be regarded as representing a real departure of the crystals themselves from the 3:2 ratio.

TABLE 2.—ANALYSES OF MULLITE BY EARLIER INVESTIGATORS

	I	II	III	IV	V	$3Al_2O_3 \cdot 2SiO_2$
	DEVILLE		VERNADSKY	COX		
SiO_2	29.1	29.5	29.7	30.07	28.89	28.2
Al_2O_3	70.9	70.2	70.3	69.93	71.11	71.8

TABLE 3.—COMPOSITION OF NATURAL SILLIMANITE

	I	II	III
SiO_2	37.08	36.70	37.1
Al_2O_3	63.11	62.73	62.9
Fe_2O_3	0.09	0.63	
	100.28	100.06	100.0

I. Sillimanite from Delaware County, Pennsylvania. U. S. National Museum No. 9752. E. G. Zies analyst. TiO_2 is less than 0.01 percent.

II. Sillimanite from Romaine, Quebec.* E. W. Todd analyst.

III. Theoretical $Al_2O_3 \cdot SiO_2$.

* Walker and Parsons. Univ. of Toronto Studies, Geol. Series No. 16, 1923, p. 36.

MULLITE FROM SEABANK VILLA, ISLAND OF MULL

As we have already stated, the natural example of this compound, to which we wish to direct attention here, occurs as minute crystals embedded in glass. It would thus appear to be unfavorable material for the establishment of a species, but as a matter of fact it can readily be separated from the glass. This was accomplished by allowing the powdered buchite to stand over night in *cold* hydrofluoric acid which completely decomposes the glass without affecting the crystals (Vernadsky's method). After decanting the HF a little concentrated H_2SO_4 is added and the mass warmed to decompose fluorides. A little HCl is then added, followed by dilution with water. The remaining powder is then caught on a filter paper, well washed, and the filter paper burned off. In this manner a powder of a delicate lilac pink is obtained which proves on examination under the micro-

scope to consist of clean, sharp crystals of mullite with no foreign material other than very rare plates of corundum. The optical determinations and chemical analyses were made on powder so obtained.

The refractive indices of these crystals are higher than those of pure synthetic mullite, an effect to be attributed to their content of TiO_2 and Fe_2O_3, as is also their pink color. The determined values are given in Table 5, and in Fig. 1.

The chemical composition of this natural mullite is given in Table 4.

TABLE 4.—ANALYSES OF MULLITE

	I	II	III
SiO_2	28.2	29.04	29.36
Al_2O_3	71.8	69.63	69.05
Fe_2O_3		0.50	0.86
TiO_2		0.79	1.12
MgO			0.10
Na_2O		0.18	
K_2O		0.06	
	100.0	100.20	100.49

I. Theoretical composition $3Al_2O_3 \cdot 2SiO_2$.

II. Mullite from Seabank Villa, Island of Mull. (Contained 0.51 per cent corundum and 0.1 per cent rutile which were determined separately.) E. G. Zies analyst.

III. Mullite from the crowns of glass pots. N. L. Bowen, analyst. Fe_2O_3 and TiO_2 by M. Aurousseau.

The other buchite examined, the analyzed material from Nun's Pass, is not significantly different from the Seabank Villa example just discussed. Treatment with HF does not, however, yield as clean a product of mullite. A considerably greater quantity of corundum as well as rather abundant minute needles of rutile are left with the mullite. It was on this account that the product obtained from the Seabank Villa buchite was used for analysis, though, no doubt in the absence of better material, the composition of the mullite in the Nun's Pass buchite could have been determined by appropriate treatment. The refractive indices were measured, however, and found to be appreciably higher than those of the Seabank Villa mullite, in fact not significantly different from those of the pot-crown crystals immediately to be described.

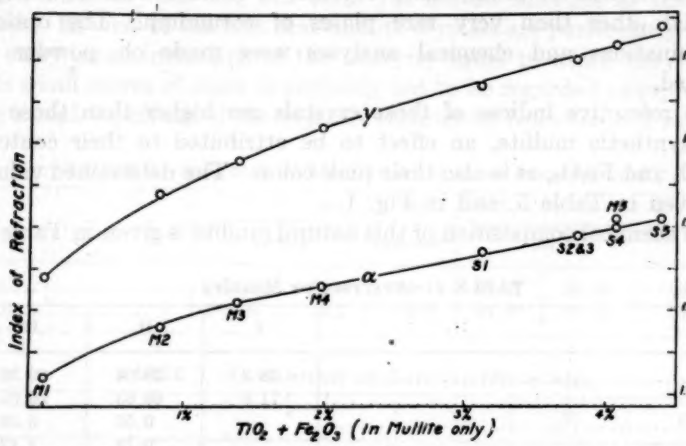

Fig. 1.—Relation between the refractive indices of various mullites and sillimanites. M1, M2, etc. = mullite I, mullite II etc. of Table 5. S1, S2, etc. = sillimanite I, sillimanite II, etc. of Table 6.

TABLE 5.—Refractive Indices of Mullites

	I	II	III	IV	V
γ	1.654	1.664	1.668	1.672	1.682
α	1.642	1.648	1.651	1.653	1.661

I. Pure mullite $3Al_2O_3 \cdot 2SiO_2$.
II. Eitel's crystals (made aluminothermically, exact composition unknown).
III. Natural mullite from Seabank Villa, Island of Mull. Analysis under II, Table 4.
IV. Mullite from pot crowns. Analysis under III, Table 4.
V. Mullite from glass pots (G. V. Wilson). Composition unknown.

TABLE 6.—Refractive Indices of Sillimanites

	I	II	III	IV	V
γ	1.677	1.680	1.680	1.682	1.684
α	1.657	1.659	1.659	1.660	1.661

I. Sillimanite from Delaware County, Pennsylvania. Analysis under I, Table 3.
II. Sillimanite from Romaine, Quebec. Analysis under II, Table 3.
III. Sillimanite from Morlaix, France. Exact composition unknown.
IV. Sillimanite from Saybrook, Connecticut. Exact composition unknown.
V. Sillimanite from Saybrook, Connecticut. Exact composition unknown.

MULLITE FROM THE CROWNS OF GLASS POTS

All wares made from clays develop mullite crystals when heated to a sufficiently high temperature. If the ware carries but little iron or titanium the mullite crystals approach pure synthetic mullite very closely in properties and therefore in composition. When much iron or titanium is present a considerable amount of these may enter into the mullite crystals with corresponding effect on their properties. Some material sent us by Mr. Donald Ross of the Findlay Clay Pot Company proved to be of the latter kind. It came from the crowns of covered pots used in the manufacture of glass during several months. The mullite crystals in this have refractive indices much higher than those of pure mullite but still appreciably lower than any sillimanite. A quantity of these crystals was separated from the glass matrix by the method already described and the clean crystals so obtained were used for determination of the refractive indices and for chemical analysis. It is to be noted that the crystals frequently contain minute tubular inclusions of the liquid (glass) in which they grew, which is highly siliceous, and these should tend to throw the composition of the analyzed sample a small distance on the silica side of the actual composition of the crystals. The results of analysis are given in Table 4. The crystals are plainly mullite containing considerable amounts of titanium and iron. Their optical properties are given in Table 5 and in Fig. 1.

OTHER EXAMPLES OF MULLITE CRYSTALS

Two other examples of mullite crystals will serve to complete the series. One of these was prepared by Eitel by an aluminothermic method. The crystals so obtained were believed to be sillimanite but careful measurement of the refractive indices by Eitel gave values much lower than those of sillimanite and only a little higher than those of pure mullite. The exact composition is unknown but observed pleochroism[7] indicates some content of TiO_2 and Fe_2O_3 and both γ and α fall at the same composition on Fig. 1, thus indicating a $TiO_2 + Fe_2O_3$ content very close to 1 per cent.

The other example was described by G. V. Wilson and comes from glass pots. Mr. Wilson has kindly sent us several specimens of glass-pot crystals and among these we find one lot of crystals whose refractive indices correspond exactly with those published by him. These indices are, as noted by Wilson, the same as those of silli-

[7] W. Eitel, Zeit. anorg. Chem. **88**: 173. 1914.

manite from Saybrook, Connecticut, within the limits of error of measurement.[8] That these crystals are not sillimanite, however, we could state on the basis of the method of their formation alone, but we have also proved that they are not, in the absence of sufficient material for chemical analysis, by means of thermal tests which establish that they are mullite.

The refractive indices suggest a content of $TiO_2 + Fe_2O_3$ upwards of 4 per cent (see Fig. 1). The notably strong pleochroism is, no doubt, connected with the comparative richness in these oxides.

THE MULLITE SERIES

In the foregoing we have discussed individual members of a series of mullites of varying $TiO_2 + Fe_2O_3$ content. The series is best brought out in the plot of refractive indices against composition, Fig. 1. This plot emphasizes the remarkable convergence of the properties of mullite upon those of sillimanite as the $TiO_2 + Fe_2O_3$ content of the mullite increases, until finally the two are, for practical purposes, no longer distinguishable in crystallographic and optical properties. Chemical and thermal properties must then be resorted to. One exception is to be noted in the matter of optical properties, namely, that when mullite has indices close to those of sillimanite it is always markedly pleochroic with γ violet-pink, β and α colorless. Thomas remarks upon this unusual pleochroism in "sillimanite." Present indications are that it is characteristic of mullite. It should be noted that even the optic axial angle, which is quite large (45°–50°) in pure mullite, becomes smaller in other members of the series. In crystals of mullite with the higher amounts of $TiO_2 + Fe_2O_3$ it is sensibly the same as in sillimanite.

Several different sillimanites showing a range of indices have been placed on the plot and tabulated in Table 6. The variation of indices in sillimanite itself is no doubt connected with variation of content of $Fe_2O_3 + TiO_2$, but in only two of those given have optical properties and chemical composition been determined on the same material. These are the sillimanite from Delaware County, Pennsylvania, which is very near the theoretical composition, and that from Romaine, Quebec, which contains a greater quantity of Fe_2O_3 (see Table 3). The other sillimanites plotted have not been analyzed. The scale of $TiO_2 + Fe_2O_3$ given on the plot applies only to mullite and not, of course, to sillimanite.

[8] Trans. Soc. Glass Tech. 2: 189. 1918.

It cannot be too strongly emphasized that there is no transition in composition from mullite to sillimanite. Their remarkable similarity in crystallographic properties would lead one to expect a series of solid solutions but all crystals made in the laboratory or found in nature have been either the one or the other with nothing intermediate.

GENETIC ASPECTS

In the identification of mullite in these high-temperature contact rocks, buchites, the findings of the laboratory are confirmed. Mullite is the stable compound of alumina and silica at high temperatures. Present indications are that mullite will be found in other contact rocks particularly in those that have been strongly heated. When the limits of stability of mullite and sillimanite have been determined these minerals will, no doubt, prove useful temperature indicators in geology.

SUMMARY

Having found, in the course of an investigation of the system, alumina-silica, that $3Al_2O_3 \cdot 2SiO_2$ is the only compound stable at high temperatures, we anticipated that this compound would be found in rocks of the appropriate composition when formed at high temperatures. We therefore examined some sillimanite buchites, so-called, from the Island of Mull, kindly supplied us by Dr. H. H. Thomas, and found that the "sillimanite" is really the $3Al_2O_3 \cdot 2SiO_2$ compound for which we accordingly propose the name, *mullite*.

The optical properties of pure mullite have been determined, as well as those of a series of mullites of varying TiO_2 and Fe_2O_3 content mounting to about 4 per cent. The properties show a remarkable similarity with those of sillimanite, the members of the series highest in $TiO_2 + Fe_2O_3$ being practically indistinguishable from sillimanite in optical properties. Chemically, however, the two compounds, mullite and sillimanite are always distinct and in spite of their crystallographic similarity there is no solid solution series between them.

Mullite will, no doubt, be found in other rocks. Its presence in some rocks and that of sillimanite in others will afford useful information regarding the relative temperatures of formation of the rocks.

AGRICULTURAL CHEMISTRY.—*Measuring the potential alkalinity of irrigated soils.* C. S. SCOFIELD, Bureau of Plant Industry.

Certain irrigated soils are unproductive because of a bad physical condition which appears to be the result of the absorption of sodium from sodium salts in the soil solution. Unless the concentration of salts in the soil solution is relatively high, these soils are not readily permeable to the movement of water through them. When leached or digested successively with distilled water, small quantities of sodium pass into solution and impart to the solution an alkaline reaction.

It has been observed that when such a soil is treated with a soluble salt of calcium or aluminum some of the calcium or aluminum is absorbed by the soil from the solution, and the molecular equivalent of other bases, including sodium, is released into the solution. This replacement of one basic element by another is utilized in certain processes of "water softening" in which the calcium and magnesium in solution in the water are absorbed by the "zeolite" or "permutit" and the equivalent quantity of sodium passes into solution. An irrigated soil that is alkaline because of its content of absorbed sodium reacts like a water softening material when treated with a solution of a calcium salt.

This reaction of the replacement of a combined basic element of the soil by another basic element from a leaching solution applied to the soil makes it possible to measure the quantity of combined sodium, or, in other words, to measure the potential sodium alkalinity of a sample of soil.

EQUIPMENT AND METHOD

The soil to be tested is air dried, pulverized to pass a two-millimeter sieve, and then dried to constant weight at 105°C. A sample of 50 grams is then taken. The soil is placed in a cylindrical glass tube of one inch diameter and six inches in length. Each end of the tube is fitted with a perforated stopper through which is inserted one arm of a small glass tube which has been bent to V-shape. Each stopper is protected from the soil by a thin plug of absorbent cotton. The tube with its charge of soil is then clamped in a vertical position to a ring-stand.

A solution of calcium chloride having a concentration of M/80 (500 ppm. Ca) is placed in a large flask on a shelf three feet above the

laboratory table and connected to the tube leading to the bottom of the soil sample. The tube leading from the top of the soil sample is connected with a flask graduated for 250 cc. This flask is stoppered with a cork having two small perforations, one for the connection with the soil tube and one for the escape of the air replaced by the incoming liquid.

A pinch-cock placed on the connection between the soil tube and the bottle of leaching solution may be used to control the rate of inflow and to cut off the supply when the collecting flask is filled to the mark. With this set-up it is possible to leach a sample of soil in a slowly moving stream of the leaching solution, and at the same time protect the solution from increasing concentration through evaporation losses.

ANALYTICAL WORK

The leaching solution should be standardized with care by testing both for calcium and for chlorin. It is convenient also to measure its electrical conductivity if a bridge is available. The percolate should be examined for total salts, for calcium and magnesium, for sulphates, for the weak acids, carbonate and bicarbonate, as well as for chlorin. It is advisable also to test for nitrates and to make a quantitative determination if appreciable quantities are indicated.

INTERPRETATION

In comparing the analytical results from the percolate with the known composition of the leaching solution it is convenient to use the method of reacting values.[1]

Thus the leaching solution should contain r Ca 25 and r Cl 25. In the percolate the sum of the reacting values of the acids indicates the millimols of salts in solution. Those in excess of the r Cl 25 contained in the leaching solution show the soluble salt content of the soil. If the calcium content of the percolate is less than r Ca 25, this indicates that the difference has been absorbed by the soil. If magnesium is found in the percolate, it may have been replaced from combination with the soil or it may have existed as part of the soluble salts of the soil. The difference between the sum of the reacting values of the calcium and magnesium in the percolate and the sum

[1] PALMER, CHASE. *The geochemical interpretation of water analyses.* U. S. Geological Survey, Bull. 479, 1911.

of the reacting values of the acids identified affords a basis for estimating the reacting values of the alkaline bases, sodium and potassium. These may be determined quantitatively also, but since the analytical processes involved are somewhat tedious it is not usually done.

The potential alkalinity of a soil may be defined as the quantity of alkaline bases obtained in solution by leaching a sample of soil with a definite quantity of a standard solution of calcium chloride. The quantity of this alkalinity may be determined directly by analyzing the percolate for these alkaline bases or by taking the difference between the reacting values of the earthy bases, calcium and magnesium, found in the percolate and the sum of the reacting values of the acids which it contains. This potential alkalinity may be stated conveniently as a certain number of reacting units per 100 grams of soil. In the method described above the ratio of percolate to soil is as 5 to 1. The analytical results from the examination of the percolate should therefore be multiplied by 5 to convert the reacting values of the solution into reacting units per 100 grams of soil.

The following table shows the data obtained from a sample of 50 grams of an alkaline soil leached with a solution of r $CaCl_2$ 25 (M/80) to yield 250 cc. of percolate. The results are given both as per 100 cc. of solution and per 100 grams of soil.

REACTING VALUES

	PER 100 CC. OF SOLUTION			PER 100 GRAMS OF SOIL
	Leaching	Percolate	Difference	Difference × 5
r Ca	25.0	13.0	−12.0	−60.0
r Mg	0.0	0.3	+0.3	+1.5
r earthy bases	25.0	13.3	−11.7	−58.5
r HCO_3	0.0	1.8	+1.8	+9.0
r Cl	25.0	26.5	+1.5	+7.5
r SO_4	0.0	0.7	+0.7	+3.5
r acids	25.0	29.0	+4.0	+20.0
r alkaline bases (by difference)	0.0	15.7	+15.7	+78.5

These results indicate that this sample of soil contained per 100 grams, 20 millimols of soluble salts and 78.5 units of alkaline bases or that its potential alkalinity was 78.5. It absorbed from the leaching solution, calcium equivalent to 60 units per 100 grams and gave up by replacement or solution 1.5 units of magnesium. It may be assumed that of the 78.5 units of alkaline bases obtained per 100 grams of soil, 20 units existed in the soil in soluble combination and 58.5 units in replaceable combination.

BOTANY.—*Further notes on Hispaniola ferns.*[1] WILLIAM R. MAXON, National Museum.

The present paper, which is in continuation of three published recently in this JOURNAL and the Proceedings of the Biological Society of Washington, relates to fern material on loan from the Berlin Botanical Museum and to specimens in the National Herbarium collected by Dr. W. L. Abbott and by E. C. Leonard in the Dominican Republic and Haiti, respectively. It includes descriptions of three new species, all from the Dominican Republic, and notes upon others that are rare or otherwise unknown from Hispaniola.

OPHIOGLOSSACEAE

Botrychium underwoodianum Maxon

Furcy, Haiti, *Picarda* 723b; *E. Christ* 1747. Morne la Selle, Haiti, altitude 2,000 meters, *E. Christ* 1851. Near Constanza, Dominican Republic, altitude 2,200 meters, *Türckheim* 3130.

Described from the Blue Mountains of Jamaica, and heretofore reported only doubtfully from Hispaniola. The present specimens, all in the Berlin Museum, are unmistakable, however. As in Jamaica, the period of maturity is August.

Botrychium jenmani Underw.

Valle Nuevo, near Constanza, Dominican Republic, altitude 2,100 meters, *Türckheim* 3130 in part.

New to Hispaniola. Described from the Blue Mountains of Jamaica, but since discovered also in Porto Rico and Cuba.

Botrychium obliquum Muhl.

Valle Nuevo, near Constanza, Dominican Republic, altitude 2,200 meters, *Türckheim* 3130b.

This species of the eastern United States has been known hitherto in the West Indies only from the Blue Mountains of Jamaica, where it is extremely rare on brushy stopes above 1,500 meters elevation.

MARATTIACEAE

Danaea urbani Maxon, sp. nov.

Plants delicate, the rhizome (incomplete) 1 to 1.5 cm. thick. Sterile fronds several, very lax, up to 60 cm. long; stipe as long as the blade, 2 mm. thick, deeply sulcate, with 2 or 3 narrow elongate nodes, dark olivaceous, finely streaked with reddish brown, deciduously brownish-paleaceous, the scales minute, suborbicular, peltate; blades lance-oblong, acuminate, imparipinnate, up to 30 cm. long and 12 cm. broad, obscurely alate, the wings expanded below the nodes; pinnae 10 to 12 pairs (the terminal one nearly conform), mostly inserted 1.5 to 2 cm. apart (the basal pair 3 cm. distant),

[1] Published by permission of the Secretary of the Smithsonian Institution.

oblique (45° to 50°), 5 to 8 cm. long, 11 to 14 mm. broad, linear or oblong-linear, inequilateral at the cuneate base (50°), long-acuminate or subcaudate in the apical fourth, stalked (2 to 3 mm.), subfalcate, the margins slightly revolute, subentire or repand-dentate in the lower half or two-thirds, beyond that sharply dentate-serrate, the teeth cuspidate; leaf tissue thin-membranous, translucent, sublustrous above, beneath much paler and bearing a few minute punctiform brown scales. Fertile fronds up to 75 cm. long, the stipe shorter than the blade, with 3 or 4 nodes; blades up to 30 cm. long and 7 cm. broad; pinnae about 15 pairs and a terminal one, stalked (2 to 5 mm.) the basal pair 4.5 cm. distant, all oblique, linear, 4 to 6 cm. long, 6 to 8 mm. broad, falcate in the outer part, the tip rather abruptly rounded-apiculate; synangia 50 to 60 pairs.

Type in the U. S. National Herbarium, no. 698,056, collected in Barahona Province, Dominican Republic, at 700 meters elevation, in moist woods, 1911, by Father Miguel Fuertes (no. 942). The data are partly taken from a sheet of the same collection in the Berlin Botanical Museum.

Distributed as *Danaea wrightii* Underw., a species of Cuba and Porto Rico, which differs in its heavier and strongly scaly stipe and rachis, its larger and thicker sterile pinnae, which are unequally rounded at base and merely acute to acuminate at apex, and its strikingly long-stalked fertile pinnae, these with half the number of synangia.

Immature specimens from Mount Morales, near Utuado, Porto Rico (*Britton & Marble* 1072), are referred to *D. urbani*, also; they differ only in having the pinnae slightly broader.

Marattia kaulfussii J. Sm.

Polo, Barahona Province, Dominican Republic, altitude 900 meters or above, *Abbott* 1830. Near Barahona, Dominican Republic, *Fuertes* 1432.

Both specimens have previously been referred[2] erroneously to *M. alata* Swartz, a species known to occur only in the high mountains of Jamaica and Cuba. Aside from the present record *M. kaulfussii* is known definitely only from South America.

POLYPODIACEAE

Hypolepis tenerrima Maxon, sp. nov.

Fronds weakly ascending, apparently up to 2.5 meters long, or more; rhizome slender, wide-creeping, with numerous coarse fibrous roots; stipe about 1 meter long, 4 to 5 mm. thick, distantly muricate, dark cinnamomeous or light castaneous from a brownish castaneous base, lustrous, glabrescent; blades 1.5 meters long or more, up to 1.5 meters broad, subtripinnate; pinnae slightly oblique, triangular-oblong to oblong-ovate, acuminate, up to 80 cm. long and 40 cm. broad, stalked (3 to 5 cm.), the secondary rachis cinnamomeous to light castaneous, glabrescent, distantly muricate or not; secondary pinnae distant, spreading (90°), lax, the basal ones a little reduced, the next 2 or 3 pairs the largest, narrowly oblong-lanceolate, long-attenuate, 16 to 20 cm. long, 5 to 7 cm. broad, the rachis stramineous to pale castaneous, lustrous, minutely puberulous; pinnules distant, spreading (90°), oblong or narrowly oblong, obtuse, those of the proximal side usually largest, 2.5 to 4 cm. long, 10 to 14 mm. broad, all but the smallest ones nearly pinnate,

[2] Proc. Biol. Soc. Washington 37: 98. 1924.

the segments joined by a narrow foliaceous wing; segments 7 to 11 pairs, slightly oblique, somewhat apart, oblong, rounded-obtuse, crenately lobed half-way to the middle (the lobes 2 or 3 pairs below the crenulate-dentate tip), scantily puberulous beneath, nearly glabrous above; veins delicate, mostly twice-forked within the lobes, the first anterior branch fertile, extending nearly to the deep sinus between the lobes; sori small, few-sporangiate (the receptacle small, elongate, slightly elevated), submarginal, subtended by a minute yellowish green, delicately membrano-herbaceous, indusiiform lobule, this concave or reflexed, glabrous, seated at the extreme sinus. Leaf tissue very delicately herbaceous, fragile, dull dark green on both surfaces.

Type in the U. S. National Herbarium, nos. 1,146,596–597, representing a complete pinna, collected in the vicinity of Paradis, Barahona Province, Dominican Republic, altitude 450 meters, January 30, 1922, by W. L. Abbott (no. 1619). Represented also by specimens collected at the same locality by Abbott (no. 1563) and by Fuertes (no. 1015), the latter determined by Brause as *H. hostilis* (Kunze) Presl.

The present species is almost certainly distinct from all described members of the genus, and, although only minutely indusiate, is perhaps nearest related to certain Brazilian plants that are still referred erroneously to *H. repens* (L.) Presl. Its most outstanding peculiarities are its extreme delicacy and the extraordinary fragility of its leaf tissue.

Hypolepis urbani Brause.

Loma Rosilla, La Vega Province, Dominican Republic, altitude 2,700 meters, July, 1912, *Fuertes* 1791b.

A study of the type material (2 sheets), lent from the Berlin Museum, necessitates some modification of the original description and a comparison with other species. Thus, the small lobules opposite the sori are not "unchanged," as stated, but are very definitely modified to thin, transversely linear-oblong, yellowish indusia of delicate texture, with fragile erose-dentate borders. *H. urbani* can not, therefore, be regarded as closely allied to *H. poeppigiana* Mett. It is much more closely allied to *H. bogotensis* Karst., which it suggests also in general aspect but from which it departs widely in its less ample indusia, thinner texture, and dense covering of minute pellucid hairs beneath. In the last respect it shows equal relationship to *H. viscosa* Karst.; but that species has a much coarser covering of distinctly glandular hairs, and indusia copiously fringed with long septate hairs.

Pteris hispaniolica Maxon, sp. nov.

Rhizome and stipe wanting; blade ternate; terminal branch wanting, presumably bipinnate; lateral branches bipartite, petiolate, the main division ovate, 55 cm. long, 25 cm. broad, the inferior division broadly ovate, 30 cm. long, 18 cm. broad, both fully bipinnate, abruptly long-acuminate, caudate, the rachises dull castaneous beneath, scabrous, scantily paleaceous, the scales dark brown, linear-attenuate, 2 to 3 mm. long, closely appressed, mostly caducous; pinnules oblique (45°), contiguous, subsessile, narrowly triangular-lanceolate, long-attenuate, 10 to 18 cm. long, 2.5 to 4 cm. broad at base, the rachis greenish-stramineous, scantily, laxly, and minutely brownish-paleaceous beneath and beset with numerous pale spines, these spreading or retrorse, mostly curved, nearly cylindrical, 0.4 to 0.6 mm. long; segments

distant (nearly or quite their own width apart), oblique, mostly simple (the basal ones sometimes enlarged and pinnatisect), linear, semiadnate, decurrent, lightly falcate, up to 2.5 cm. long, 3 to 4 mm. broad, acutish at apex, the tip whitish-cartilaginous, mucronate; margins of sterile segments rigidly recurved, cartilaginous, rigidly incurved-serrate toward the tip, the firm whitish border joining the enlarged whitish arcuate vein-ends throughout; costae prominent, sulcate, and glabrous above, very strongly rounded and elevated beneath, sparingly septate-fibrillose at base and bearing a few blunt spines; veins 10 to 13 pairs, oblique, mostly once forked near the costa, evident above, beneath thick, whitish, broad, slightly elevated, glabrous; leaf tissue very rigidly herbaceo-coriaceous, grayish green and sublustrous above, paler beneath; indusia ample, about 0.8 mm. broad, not reaching the tip, abruptly discontinuous, firm, whitish, brownish with age.

Type in the Berlin Botanical Museum, collected on Morne de la Hotte, Département du Sud, Haiti, at 1,400 meters altitude, August 7, 1917, by E. L. Ekman (no. 525). A second specimen from Haiti (Mission, altitude 1,200 meters, *Leonard* 3900) represents what may be an atypical juvenile form of the same species; in this the segments are mostly sessile or even short-stalked, but in minute characters it is identical.

The relationship of *P. hispaniolica* is with *P. coriacea* Desv., as which it was determined by Brause. From that species it differs notably, however, in its gray-green (not strongly yellow-green) color, and its oblique, linear, distant, semiadnate segments, the segments of *P. coriacea* being relatively much broader, close together, and wholly adnate. The rachises of the pinnules are strongly flexuose in *P. coriacea*, but not at all so in *P. hispaniolica*.

Polypodium jenmani Underw.

Morne de la Hotte, Haiti, altitude 800 meters, *Ekman* 153.

New to Hispaniola, having been known heretofore only from Jamaica and Cuba.[3]

Polypodium arcuatum Moritz.

Loma Rosilla, La Vega Province, Dominican Republic, altitude 1,300 meters, in wet forest, *Fuertes* 1781.

The specimens, so determined by Brause, afford an interesting extension of range for this species, which has been known only from South America. It may now be reported from Jamaica, also, on the basis of the following specimens, all from the vicinity of Vinegar Hill, altitude 1,200 meters: *Hart* 169; *Underwood* 2597; *Maxon* 1524, 2778, 2786.

Polypodium plesiosorum Kunze.

Las Lagunas, Azua Province, Dominican Republic, altitude 1,000 meters, *Fuertes* 1854.

Apparently new to the West Indies; agreeing fairly well with some of the Mexican and Central American material referred to this species.

Polypodium surucuchense Hook.

Loma Rosilla, La Vega Province, Dominican Republic, altitude 1,300 meters, *Fuertes* 1770. Near Constanza, Dominican Republic, altitude 1,300 meters, *Türckheim* 3220.

[3] Journ. Wash. Acad. Sci. **12**: 440. 1922.

This species in one form or another occurs on the continent from Guatemala to the Andes of Ecuador. In the West Indies it has been known previously from Jamaica, Martinique, and Guadeloupe.

Oleandra guatemalensis Maxon.

Morne de la Hotte, Haiti, altitude 1,400 meters, on decayed tree trunks, *Ekman* 547.

The specimen at hand, lent from the Berlin Museum, is the type of *O. urbani* Brause. It is in no way distinguishable from *O. guatemalensis*, known otherwise only from Guatemala.

Dryopteris linkiana (Presl) Maxon.

Gymnogramma diplazioides Desv. Mém. Soc. Linn. Paris **6**: 214. 1827.
Dryopteris diplazioides Urban, Symb. Ant. **4**: 21. 1903, not Kuntze, 1891.
Gymnogramma polypodioides Link, Hort. Berol. **2**: 50. 1833, not Spreng. 1827.
Grammitis linkiana Presl, Tent. Pter. 209. 1836.
Nephrodium linkianum Diels in Engl. & Prantl, Pflanzenfam. 1^4: 172. 1899.

Mission, Fond Varettes, Haiti, in thickets on mountain slopes; occasional, *Leonard* 4001.

This species was described originally from Haiti, but seems to have been known otherwise from Hispaniola only upon the basis of a specimen in the Copenhagen Herbarium, collected by Thouin. The present specimen has a slender erect rhizome more than 15 cm. long and leaves 145 cm. long; the blade has 6 or 7 pairs of greatly reduced basal pinnae, the lowermost merely vestigial.

Under the American Code the name *Dryopteris diplazioides* (Desv.) Urban, 1903, is not available for this species, the same combination having been proposed by Kuntze in 1891 for the very different plant of Venezuela described in 1858 as *Aspidium diplazioides* Moritz. Only the essential synonymy is given above.

SELAGINELLACEAE

Selaginella lasiophylla A. Br.

Summit of Loma Atravezada, at base of Punta Cabrón, Samaná Peninsula, Dominican Republic, altitude 600 meters, *Abbott* 2941.

Apparently new to Hispaniola. The identification is by comparison with a specimen from Troy, in the "Cockpit" region of western Jamaica (*Maxon* 2845), so determined long ago by Hieronymus. The species is unusual in its delicately scabrid-setulose leaves.

Selaginella longispicata Underw.

Mao, Santiago Province, Dominican Republic, altitude 100 to 300 meters, *Abbott* 1035.

A remarkable extension of range for this species, which has been known hitherto only from Yucatán. The specimens offer no special points of distinction from Yucatán material, of which the following specimens are at hand: *Gaumer* 825 (3 sheets); *Valdez* 50; *Schott* 669.

ZOOLOGY.—*New genus and species of South American snakes contained in the United States National Museum.* AFRANIO DO AMARAL, Inst. Butantan and Mus. Paulista, S. Paulo, Brazil. (Communicated by L. Stejneger).

A careful study recently made of a large number of unidentified South American snakes contained in the United States National Museum has afforded me the opportunity to find several forms which appear to be new to science.

Acknowledgment is hereby extended to Dr. L. Stejneger and Miss D. Cochran for inviting me to identify the collection and for their kind assistance throughout my study.

Rhadinaea albiceps, sp. nov.

Head slightly distinct from neck; snout short, moderate. Maxillary teeth increasing in size posteriorly; mandibular teeth subequal. Rostral nearly twice as broad as deep, scarcely visible from above; internasals small, half as long as the praefrontals; frontal a little longer than broad and longer than its distance from the end of the snout, shorter than the parietals; nasal divided; loreal a little longer than deep; one praeocular not reaching the upper surface of the head; one small subocular below the praeocular; postoculars 2, the lower very small; temporals 1 + 2; upper labials 8, the 4th and 5th entering, the orbit; 1st lower labial in contact with its fellow behind the symphysial, the 5 lower labials contiguous to the anterior chin-shields which are a little longer than the posterior. Scales smooth, without pits, in 17 rows. Ventrals 121, rounded laterally; anal divided; subcaudals 122 pairs.

Seal brown above, with two whitish stripes on each side, the outer running from the side of the nape to the tip of the tail on the 1st row of scales, the inner, not so marked, running only up to middle of the tail on the 5th row of scales; head whitish up to the occiput, with a brown spot between the anterior temporal and the 7th upper labial; whitish yellow beneath; sides of the ventrals brown.

Type: Adult ♂, no. 22,446 in the collection of the U. S. National Museum, sent, probably from Ecuador, by Mark B. Kerr, in May, 1895.

Total length 350 mm.; tail 154 mm. (3/7 of the total).

This species is closely allied to *R. decorata* (Gthr.), from which it differs in coloration and in the proportional size of the chin-shields. Its dorsal markings are like those of *Erythrolamprus labialis* Werner,[1] from Ecuador.

Sibynomorphus macrostomus, sp. nov.

Body slender, laterally compressed; head somewhat distinct from neck; pterygoid teeth present; eye large. Rostral broader than deep, scarcely visible from above; internasals half as long as the praefrontals; frontal hexagonal, a little longer than broad and longer than its distance from the end of the snout, shorter than the parietals; nasal entire; loreal large, a little longer than deep; no praeocular; postoculars 2; temporals 2 + 3; upper labials 10/11, the 4th, 5th, 6th, and 7th entering the orbit; 1st lower labial in contact with

[1] Werner. Über n. o. s. Rept. d. nat. Mus. Hamburg, 1: 237. 1909.

its fellow behind the symphysial; 4 pairs of chin shields, anterior longer than broad, others subequal. Scales in 15 rows, vertebral moderately enlarged; ventrals 204; anal entire; subcaudals 98 pairs.

Clove brown with 34 cream-buff annuli which sometimes show small brown spots; head clove brown; occiput, lips, and throat cream-buff, irregularly spotted with brown.

Type: ♀, no. 14,047 in the collection of the U. S. National Museum, caught in Ecuador by Dr. Wm. H. Jones and sent with other snakes to Prof. Cope in July, 1886.

Total length 240 mm.; tail 63 mm.

This is allied to *S. hammondii* (Blgr.),[2] *gracilis* (Blgr.),[3] and *palmeri* (Blgr.),[4] which also are from Ecuador, *S. articulatus* (Cope),[5] type from Costa Rica, *S. barbouri* Amaral,[6] type from Alagoas, Brazil, and *S. peruanus* (Boettger),[7] type from Peru. It differs from *hammondii* and *gracilis* in having a higher number of temporals, upper labials, and chin-shields, a lower number of subcaudals, and many more light rings on the body; from *palmeri* in having a higher number of upper labials, chin-shields, and ventrals; from *articulatus* in having a higher number of upper labials (only three labials enter the orbit in *articulatus*) and a lower number of subcaudals; from *barbouri* in coloration and in having a higher number of upper labials; and, finally, from *peruanus* in coloration and in having a higher number of upper labials, ventrals, and subcaudals.

Barbourina, gen. nov.

Head slightly distinct from neck; eye moderate, with vertically elliptical pupil. Maxillary teeth 8, subequal, followed, after a short interspace, by a pair of sword-like, moderately enlarged grooved fangs, situated just behind the vertical of the posterior border of the orbit; mandibular teeth small, subequal. Body cylindrical; scales smooth, without pits, in 17 rows, vertebral enlarged throughout the body, about one and one-third as broad as long. Tail moderate; subcaudals in two rows.

Barbourina has the same general physiognomy of *Pseudoboa* Schneider, 1801, from which, however, it may be separated by the dorsal pholidosis and the dentition.

It is named in honor of Thomas Barbour, the distinguished herpetologist of the Museum of Comparative Zoology.

Barbourina equatoriana, sp. nov.

Snout round and scarcely projecting. Rostral a little deeper than broad, its portion visible from above equal to 1/3 its distance from the frontal; internasals twice as broad as long, half as long as the praefrontals; frontal a little longer than broad and longer than its distance from the end of the

[2] Boulenger. Ann. Mag. Nat. Hist. **6**: 110. 1920.
[3] Boulenger. Ann. Mag. Nat. Hist. **9**: 57. 1902.
[4] Boulenger. Ann. Mag. Nat. Hist. **10**: 422. 1912.
[5] Cope. Proc. Acad. Nat. Sci., Philadelphia. **1868**: 135.
[6] Amaral. Proc. N. E. Zool. Club. **8**: 92. 1923.
[7] Boettger. Kat. Rept. Mus. Senckenb. **2**: 128. 1898.

snout, a little shorter than the parietals; nasal entire, in contact with the praeocular (on the right) which does not reach the upper surface of the head; no loreal; 2 small postoculars, subequal; temporals 2 + 3; 7 upper labials, the 3d and 4th entering the orbit; 2d touching the praefrontal on the left; 1st lower labials in contact with its fellow behind the symphysial; 4 lower labials in contact with the anterior chin-shields which are a little longer than the posterior. Scales in 17 rows. Ventrals 204, rounded laterally; anal entire; subcaudals 75 pairs.

Pinkish-yellow (red?) above, all the scales tipped with black; head brown above, with a yellowish-white band occupying the parietals, temporals, the 3 posterior upper labials, and the occiput, and followed by a dark blotch on the nape; chin dark; throat and lower surface of the body and tail yellowish-white.

Type: ♂, no. 62,790 in the collection of the U. S. National Museum sent from Guayaquil, Ecuador, by F. W. Goding, in April, 1920.

Total length 300 mm.; tail 60 mm.

Elapormorphus suspectus, sp. nov.

Rostral as deep as broad, the portion visible from above 2/3 as long as its distance from the frontal; internasals broader than long, their suture half as long as the single praefrontal; frontal one and half times as long as broad, a little shorter than its distance from the end of the snout, much shorter than the parietals, which are more than twice as long as broad; praeocular 1, in contact with the entire nasal; postoculars 2; temporals 1 + 1; upper labials 6, the 2d and 3d entering the orbit; 4 lower labials in contact with the anterior chin-shields, which are a little longer than the posterior. Scales in 15 rows. Ventrals 212; anal divided; subcaudals 31 pairs.

Pale brown above, speckled with black, with a black narrow punctuate vertebral line, and a broad black lateral band from the side of the neck to the tip of the tail, covering the 4th and the lower half of the 5th scale rows; the 3 rows of scales below this band entirely yellowish-white; head dark brown above, with a yellow, black-edged occipital collar; lower lip spotted with dark brown; ventrals black, light-edged; a black bar across the base of the tail; lower surface of the tail yellowish-white with a black narrow line along the middle.

Type: ♂, no. 48,939 in the U. S. National Museum, collected in Pilár, near Córdoba, Argentina, by Dr. C. C. Craft, and received on May 15, 1912.

Total length 308 mm.; tail 28 mm.

This species is closely allied to *E. lemniscatus*, from which it differs greatly in coloration.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

THE ENTOMOLOGICAL SOCIETY

360TH MEETING

The 360th meeting was held November 1, 1923, with President Howard in the chair and 32 persons present.

Program: R. E. SNODGRASS: *Insect musicians, their music and their instruments.*

Every year there is a regular program of insect music, beginning the latter part of May or the first of June with the chirps of that group of *Gryllus assimilis* that winters in a nymphal stage. Later, about the first of July, the tree crickets mature and their commingled notes from now on form that continuous sound heard every night till cold weather. Against this background the notes of other species are heard rather as individual songs than as parts of the general chorus. These include the notes of the various members of the katydid family and those of other crickets. The true katydid is generally found only in undisturbed woods and is not commonly a member of the dooryard troupe either in town or in open country places.

The daylight singers include the cicadas, a few of the grasshoppers, and many species of katydids and crickets that sing both by day and by night.

The principal singing insects belong to three families of the Orthoptera, the Acrididae, the Tettigoniidae, and the Gryllidae, and to the Cicadidae of the Hemiptera. Many others make squeaking or rasping sounds of various sorts, but they are not often heard.

The grasshoppers or locusts (Acrididae) make their notes by scraping the hind femora over the tegmina. The katydids (Tettigoniidae) and the crickets (Gryllidae) produce their sounds by rubbing over each other the basal parts of the wings on which are situated the stridulating organs. In the katydids the file is usually developed on the left wing only and these insects always keep the left wing uppermost. The crickets, on the other hand, usually keep the right wing uppermost, though the file is equally developed on each wing. Exceptions occur in *Gryllus assimilis*, some individuals of which are "left handed."

The cicadas produce their notes by special tympana situated on the sides of the first abdominal segment, which are set into vibration by special muscles. The sound is reinforced by the great air chamber of the abdomen and by membranes on the lower part of the first abdominal segment.

There is not sufficient evidence at hand to substantiate the common idea that the song of the male insect is in itself attractive to the female or that the singing of the male is directly excited by a desire for the female. The sound of the singing probably lets the female know the whereabouts of the male, but, in some of the crickets at least, the female is lured to the male by a liquid exuded on the back of the metathorax of the male while he is singing. On the other hand common observations furnish evidence that male crickets sing when they are not in a matrimonial mood, and at times when the presence of the female is even an annoyance to them. The presence of another male is a much surer excitation to song than the presence of a female. (*Author's abstract.*)

A. G. Böving: *The historical development of the term "triungulin."* The first instar of blisterbeetles has been known far back in the past. Goedart in 1667 and Frises in 1727 described and correctly determined it. Linnaeus and Raaumur, however, took it as an apterous insect, placed it in the genus *Pediculus*, and named it *Pediculus apis*. Fabricius followed Linnaeus, but deGeer, who reared it from eggs, plainly stated that *Pediculus apis* L. is a first instar Meloid-larva. Since then several authors at different times have confirmed his statements as to the origin of the parasite. It is however interesting to note that many of the most prominent entomologists repeatedly took reservations, and by pure speculation maintained the idea that it belonged to the apterous hexapods. Among those are Kirby (1802) and Dufour, who in 1828 carried the idea of Linnaeus and Kirby one step further,

classifying the parasites in a distinct genus *Triungulinus* between *Pediculus* and *Racinus;* and almost one hundred years from the time of Reaumur Westwood still upholds the faulty interpretation. Through Serville's, and especially Newport's, investigations the more than hundred-year old discussion was settled in favor of the first discoverer and describer of the natural history of the blisterbeetles, Goedart.

Since Dufour proposed the name *Triungulinus* for what he considered as a genus of Aptera the first instars of Meloid larvae have often been called triungulins. This name, however, is not suitable, partly because only a small minority of Meloid larvae have the characteristic armature of three claws at the end of the tibia, partly because this armature really is to be interpreted as a single median claw-shaped or spathulate tarsus with two strong setae laterally at base, and partly because the triunguline armature is not restricted to larvae of the family Meloidae but lately has been found also in a larva of the family Lampyridae, collected by Dr. Mann in Bolivia in 1921 and now preserved in the National Museum. Newport and Fabre never use the term "triunguline," but always the term primary larva for the first instar of Meloid larvae, and the greatest living authority on that family, Dr. A. Cros, has adopted this same term, and in a special very interesting article (1917) set forth how inadvisable the continued usage of the term "triungulin" is.

Dr. M. C. HALL, Bureau of Animal Industry: *Lesions due to the bite of the wheel-bug,* Arilus cristatus (*Hemiptera; Reduviidae*). In the fall of 1922, the writer's youngest daughter (M. L. H.) aged 10, captured a wheel-bug, *Arilus cristatus* (determined by W. L. McAtee), at Chevy Chase, D. C., and was bitten twice by it on the inner aspect of the little finger of the right hand at a point near the nail. The bite was painful, about as much so as a bee sting, according to the child, and the finger felt hot to the touch. In the course of a few days growths resembling papillomata developed at the site of the punctures, the largest projecting as a small horn-like structure. Both of the growths persisted for months, the largest slowly disappearing between six and nine months after the infliction of the bite. The injured finger remained warmer than the other fingers during this period and, according to the patient, still feels warmer than the others a year later. The development of pronounced cutaneous growths after a bite appears not to have been reported as following the bite of members of the Heteroptera. Previous reports show that there may be transient or prolonged local inflammatory reactions at and near the site of the injury and more or less severe general reactions lasting a short time or persisting for almost a year.

Over 30 species of Heteroptera have been reported as attacking man, and probably many more than 30 attack man occasionally. At least 9 genera are reported as attacking man in North America; these genera include *Cimex, Opsicoetes* (Reduvius), *Apiomerus, Triphleps, Arilus* (the present note), *Conorhinus, Rasahus, Melanolestes,* and *Reduviolus.*

Dr. SCHWARZ said that he thought the wheel-bug bite was more painful than the sting of the honey-bee because the pain lasted for several days.

Dr. BALL said that he had received a bite on his finger from a water-bug, the effects of this bite lasting for 6 weeks.

CHAS. T. GREENE, *Recording secretary.*

SCIENTIFIC NOTES AND NEWS

On account of the separation of Esthonia from Russia, the Russian University of Dorpat was transferred to Voronesh at the end of the year 1918, while an Esthonian University was founded at Dorpat. The University of Voronesh at present consists of four Faculties: Medicine, Physics and Mathematics, Pedagogy, and State-Sciences. The Faculty consists of 650 members and the number of students in attendance is 5000. The University is handicapped by the loss of the old Library, and although a large number of books have been collected for the new library, there are many missing numbers of various journals. The University publishes the Acta Universitatis Voronegiensis and is desirous of entering into exchange with Societies and Institutions. Communications may be addressed to the State University, Voronesh, Russia, or to its representative, Mr. W. Breitfuss, Berlin W. 30, Gleditschstrasse, 40 I, Germany.

The new building of the National Academy of Sciences and National Research Council, at Twenty-second and B streets, near the Lincoln Memorial was dedicated on Monday, April 28, during the meetings of the Academy.

Dr. F. HASTINGS SMITH, of the Geophysical Laboratory, left Washington in April to spend a year in England and continental countries. In October, he will attend the meetings of the International Union of Geodesy and Geophysics at Madrid.

L. W. STEPHENSON of the U. S. Geological Survey has returned from South America, where he has been engaged in private work for six months.

WILLIS T. LEE has been granted leave of absence for the rest of the year from the Geological Survey and will make a detailed study of the Carlsbad Cave in Arizona for the National Geographic Society.

KENNETH C. HEALD, chief of the oil and gas section of the Geological Survey, has been appointed associate professor of Geology at Yale University with assignment to the Sheffield Scientific School. He will continue his work for the Geological Survey until next September.

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